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# 1974 VIRUS TOLERANCE RATINGS FOR CORN STRAINS Grown in the Lower Corn Belt

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In cooperation with  
Missouri Agricultural Experiment Station  
and  
Ohio Agricultural Research and Development Center

ARS-NC-21  
February 1975

U.S. DEPT. OF AGRICULTURE



## Summary

To measure the tolerance of corn to natural virus infection by maize dwarf mosaic and maize chlorotic dwarf, breeders and researchers grew selected corn strains in test plots in lower parts of the Corn Belt. The results of these tests are given in this publication in two parts—corn strains grown in Missouri and those grown in Ohio.

Observers of the individual corn plants rated symptoms on a scale from 1 (no virus symptoms) to 9 (complete susceptibility). Infections varied in intensity between hybrids and inbreds; the vigorous hybrids were not as attractive to the insect vector as the immature tissues of the less vigorous inbred plants. At all test locations, johnsongrass, an alternate host, was abundant near the plots. The rating variations within tests of inbreds and single cross and double cross hybrids are shown in tables in this publication.

1974 VIRUS TOLERANCE RATINGS  
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# Virus Tolerance Ratings for Corn Strains Grown in Missouri<sup>1</sup>

by

M. S. Zuber, O. H. Calvert, A. J. Keaster, and E. W. Palm<sup>2</sup>

Corn strains, grown in test plots in Missouri, were rated for virus symptoms as a result of natural infection. Inbred lines and single cross and double cross hybrids were planted in replicated plots located at the Bonacker Farm near House Springs in Jefferson County and at the Delta Center near Portageville in Pemiscot County.

The plots were hand-planted with 20 plants of each strain, spaced 1 foot apart within the row. Each entry had three replications.

Planting was delayed until late May to enhance the chances for higher levels of natural virus infections. Johnsongrass, an alternate host, was abundant near the testing site at House Springs and in the immediate area at the Delta Center.

Virus ratings were made on several different dates at each location. Each plant within a plot was rated on a scale from 1 (no virus symptoms) to 9 (complete susceptibility)—ratings are explained in the Ohio results section, page 11. Data reported are the averages of the three replications for each entry.

The percentage of infected plants for each entry was not reported this year because virus ratings and percentage of infected plants gave about the same information.

## Virus Incidence

Maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV) were present in both locations, as identified by plant symptoms. Leaves infected with MDMV had a typical mosaic pattern, whereas leaves infected with MCDV showed tertiary vein clearing. This vein clearing

was more apparent when the leaf was held to the light, and parallel veins appeared more prominent.

For both viruses johnsongrass is an alternate host. The corn leaf aphid and other aphids transmit MDMV from infected johnsongrass. The virus can also be mechanically transmitted. The vector for MCDV is the blackfaced leafhopper, *Graminella nigrifrons*, but it has not been transmitted mechanically.

As each plot was rated on a 1 to 9 basis, it was also scored for either MDMV or MCDV symptoms, or both. MCDV was the predominant virus at each location.

Among the corn strains rated, no consistent differential response to the two viruses was detected.

The 1974 average virus ratings at the House Springs location were nearly as high as any of the previous average ratings spanning the period from 1968 to 1974 (table 1). At the Delta Center location, the 1974 average ratings were considerably lower than in 1973 and were below the 7-year average. Although the johnsongrass population in the immediate area of the plot site at the Delta Center location was about the same both years, the lower level of virus infection was attributed to a low vector population early in season because of the extremely wet and cool temperatures during that period. Although data from these two locations on individual plants were recorded for symptoms of either or both MDM and MCD, only the average ratings were reported.

Table 1.—Comparative virus ratings<sup>1</sup> over 7-years at two locations for two single crosses—one susceptible and one tolerant to virus.

Single cross	1968	1969	1970	1971	1972	1973	1974	Average
<b>Jefferson County:</b>								
Mo5 × H55	8.00	8.20	7.30	7.60	7.00	7.00	8.20	7.61
Mol4W × Oh7B	1.67	5.81	4.00	4.70	2.33	1.30	3.60	3.34
<b>Pemiscot County:</b>								
Mo5 × H55	4.67	6.33	5.33	7.00	3.67	7.00	3.70	5.39
Mol4W × Oh7B	1.35	1.00	1.70	1.00	1.00	2.30	1.70	1.44

<sup>1</sup>Rating scale from 1 (no symptoms) to 9 (complete susceptibility).

<sup>1</sup>Cooperative investigation between Agricultural Research Service, U.S. Department of Agriculture and the University of Missouri Agricultural Experiment Station Series Number 7194.

<sup>2</sup>Research agronomist, Agr. Res. Ser., U.S. Dept. Agr. and professor of agronomy; associate professor of plant pathology; associate professor of entomology; and associate professor of plant pathology, all of the University of Missouri, Columbia.



We made the assumption that virus infections varied in intensity between hybrids and inbreds planted in the proximity of one another. Hybrids were more vigorous and had progressively higher degrees of internode elongation than did inbreds. Hence, the more immature tissues of the less vigorous inbreds probably were more attractive to insect vectors than were hybrids.

The coefficients of variation for experiments conducted in 1974 ranged from 15.8 to 21.9 percent. This range is considerably less than in former years. The range in 1973 was from 11.0 to 43.0 percent. The lower range in 1974 was attributed to ratings being made on individual plants; whereas, in 1973, ratings were made on a plot basis except for several small inbred line experiments.

### Commercial Hybrids

Virus ratings for 73 commercial hybrids, two check hybrids, and one exotic strain tested at the Delta Center (Exp V-1) are given in table 2 and at House Spring (Exp V-2), in table 3. The level of infection at the House Springs location was sufficient to identify strains with high levels of tolerance. The low infection level at the Delta Center could only identify a few strains with high levels of susceptibility. Virus rating data from both locations were subjected to an analysis of variance.

The variance analysis showed highly significant differences among entries; and the interaction of entries by location was also highly significant, indicating that hybrids were not giving the same response at the two locations. This differential response was attributed to the low level of infection at the Delta Center location. At the House Springs location, no significant difference was noted among the first 33 entries of the 76 testers, with virus ratings ranging from 2.9 to 4.0.

### Uniform Test of Inbred Lines

A uniform test of 15 inbred lines, sponsored by the Southern Corn Improvement Conference, was grown at the Delta Center (Exp V-3) and at House Springs (Exp V-4). Uniform tests afford breeders, plant pathologists, and virologists the opportunity to observe and compare virus ratings for the same group of inbred lines grown under several environments. The 15 inbred lines were selected for differential responses to the two corn viruses (MDMV and MCDV) and to corn stunt (a mycoplasma disease).

Table 2. — 1974 virus ratings for commercial hybrids, two check single crosses and an exotic population. Grown at the Delta Center, Pemiscot County, Missouri. Planted May 29 and rated July 24. Experiment V-1.

Hybrids	Virus ratings	DMRT <sup>1</sup>
Funks 26543	1.1	
McCurdy 17514	1.2	
IFS 101	1.3	
Sieben Hybrids 26XS	1.4	
Crows 344	1.4	
NC+ 85SX	1.4	
DeKalb XL72B	1.4	
IFS 503W	1.4	
Golden Harvest H-2740	1.5	
Holden 1054	1.5	
Funks 26550	1.5	
DeKalb EX48519	1.5	
IFS 105	1.5	
Hulting Hybrids X980	1.5	
Pioneer 3145	1.5	
Princeton SX910	1.5	
Funks 25601	1.5	
Hulting Hybrids Exp. 73649	1.5	
PAG 226004W	1.5	
DeKalb EX48009	1.6	
Northrup King PX737	1.6	
Sieben Hybrid 46SX	1.6	
Golden Harvest H-2676	1.6	
Crows 343	1.6	
DeKalb XL70	1.6	
McCurdy 7474	1.6	
Trojan X3224	1.6	
Ibadon B <sup>2</sup>	1.6	
McNair 508	1.7	
ACCO AR20924	1.7	
Holden 1026	1.7	
Mol4W x Oh7B <sup>3</sup>	1.7	
Pioneer X1382	1.7	
Funks G-4762	1.7	
McCurdy MSX85	1.7	
Holden 1052	1.8	
Trojan X152	1.8	
Stulls SX2722	1.8	
Northrup King PX91	1.8	
Holden 1053	1.8	
ACCO uc10094	1.8	
Golden Harvest H-2831	1.8	
Trojan X142	1.8	
Pfister 47	1.8	
ACCO AR38313	1.8	
Golden Harvest H-2626	1.8	
McNair 73011	1.8	
Crows 253	1.9	
Crows 778	1.9	
Stulls WF2721	1.9	
Sieben Hybrids 72SPX	1.9	
NC+ 61	1.9	
PAG SX17A	1.9	
IFS 104	1.9	
Stulls SX2744	1.9	
Sieben Hybrids 36XS	1.9	
Pioneer X2414	1.9	
McCurdy 71-6	1.9	
Trojan X3524	2.0	
NC+ 57	2.0	
McNair X300	2.0	
ACCO uc9792	2.0	
Pfister Exp. 371042	2.1	
Pfister 54	2.1	
Stulls SP2777	2.2	
NC+ 59	2.2	
PAG 22354	2.2	
Princeton SX630	2.3	
Hulting Hybrids X8778	2.3	
Princeton MD885	2.4	
Princeton 3147	2.4	
McNair 73002	2.5	
Hulting Hybrids Exp. 74174	2.6	
Coop S-318	2.6	
Pfister 76	3.1	
H55 x Mo5 <sup>3</sup>	3.7	
Coefficient of variation		percent 19.1
Least significant difference		.94

<sup>1</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

<sup>2</sup>Exotic strain.

<sup>3</sup>Check hybrids.

Table 3. — 1974 virus ratings for commercial hybrids, two check hybrids and an exotic population grown in Jefferson County, Missouri. Planted May 23 and rated August 6. Experiment V-2.

Hybrids	Virus ratings	DMRT <sup>1</sup>
Ibadon B <sup>2</sup>	2.9	
Trojan X142	2.9	
Funks 25601	2.9	
Holden 1054	3.0	
McCurdy 17514	3.1	
McCurdy 7474	3.1	
ACCO uc10094	3.2	
PAG 22354	3.2	
IFS 101	3.3	
Pioneer X1382	3.3	
Trojan X3524	3.3	
Holden 1053	3.3	
Pioneer X2414	3.3	
Funks 26543	3.3	
IFS 503W	3.3	
Pioneer 3145	3.3	
Golden Harvest H-2740	3.3	
Pioneer 3147	3.4	
DeKalb XL70	3.4	
DeKalb EX48009	3.5	
Trojan X152	3.5	
Crows 253	3.5	
Mol4W x Oh7B <sup>3</sup>	3.6	
Trojan X3224	3.6	
Funks 26550	3.6	
McCurdy 71-6	3.7	
DeKalb EX48519	3.7	
DeKalb XL72B	3.8	
IFS 105	3.8	
Ibadon B	3.8	
Sieben Hybrids 26XS	3.9	
Crows 344	3.9	
Crows 778	4.0	
Funks G4762	4.1	
Princeton SX910	4.2	
ACCO uc9792	4.3	
Northrup King PX91	4.3	
McNair 73011	4.3	
McNair 508	4.4	
Stulls SX2722	4.4	
McCurdy 71-6	4.4	
PAG 226004W	4.4	
ACCO AR20924	4.5	
Golden Harvest H-2626	4.5	
Northrup King PX737	4.5	
NC+ 57	4.6	
Crows 343	4.6	
Golden Harvest H-2831	4.6	
NC+ 85SX	4.7	
Hulding Hybrids Exp. 73649	4.8	
Holden 1052	4.9	
IFS 104	4.9	
Stulls WF2721	4.9	
ACCO AR38313	5.0	
Princeton MD885	5.0	
Pfister 54	5.0	
Stulls SC2744	5.0	
Princeton SX630	5.1	
Hulding Hybrids X980	5.2	
Sieben Hybrids 46XS	5.2	
Stulls SP2777	5.2	
Golden Harvest H2676	5.2	
Sieben Hybrids 72SPX	5.2	
NC+ 61	5.2	
Pfister 47	5.3	
Hulding Hybrids Exp. 74174	5.3	
Coop S-318	5.3	
NC+ 59	5.4	
Sieben Hybrids 36XS	5.4	
McNair 73002	5.6	
McNair X300	5.6	
Holden 1026	5.6	
Pfister 76	5.9	
Pfister Exp. 371042	6.0	
Hulding Hybrids X8778	6.6	
H55 x Mo5 <sup>3</sup>	8.2	

Coefficient of variation

percent 19.1

Least significant difference

.94

<sup>1</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

<sup>2</sup>Exotic strain.

<sup>3</sup>Check hybrids.



Table 4. — 1974 virus ratings for a uniform test of inbred lines<sup>1</sup> grown at the Delta Center, Pemiscot County, Missouri. Planted May 29. Experiment V-3.

Inbred line	Virus ratings	DMRT <sup>2</sup>
Rating date July 2		
B77	1.0	
T232	1.0	
Tx601	1.0	
T240	1.0	
Mp490	1.0	
Mo18W	1.0	
Oh513	1.0	
Sc301D	1.0	
SC229	1.0	
CI90C	1.0	
Mo20W	1.1	
Ab28A	1.1	
T143	1.1	
B37	1.4	
H55	1.6	
Rating date July 24		
Oh513	1.4	
Tx601	1.7	
Mo20W	1.8	
Mo18W	2.1	
SC229	2.1	
B37	2.2	
T232	2.3	
Mp490	2.3	
T143	2.3	
T240	2.5	
B77	3.1	
SC301D	3.1	
CI90C	3.2	
Ab28A	3.7	
H55	4.7	
Rating date August 8		
T232	3.2	
Tx601	3.4	
T240	3.8	
T143	4.2	
Oh513	4.3	
Mo18W	4.3	
Mo20W	4.4	
SC229	4.5	
Mp490	4.5	
B37	4.6	
SC301D	4.7	
B77	4.7	
CI90C	5.6	
Ab28A	7.5	
H55	7.7	
Coefficient of variation	percent	20.1
Least significant difference		.90

<sup>1</sup>Sponsored by the Southern Corn Improvement Conference.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

The virus ratings for the uniform test grown at the Delta Center (Exp V-3) are reported in table 4. Ratings were made on three different dates. No significant difference was found among entries rated on July 2. Ratings, however, made on the same entries on July 24 and August 8 were significantly different, and virus symptoms became progressively more severe with time.

Virus ratings for the same group of lines grown at House Springs (Exp V-4) are shown in table 5. Ratings were made at two dates, and differences among entries were highly significant. Again, the virus ratings were higher at the later dates.

The interaction of entries by rating dates was highly significant at both locations, suggesting that some inbred lines did not give the same relative ratings on the different rating dates. The inbred line Mo20W had a much lower average rating in relation to other inbred lines at the House

Table 5. — 1974 virus ratings for a uniform test of inbred lines<sup>1</sup> grown in Jefferson County, Missouri. Experiment V-4.

Inbred line	Virus ratings	DMRT <sup>2</sup>
Rating date July 16		
T143	1.0	
Oh513	1.1	
Mo20W	1.2	
T240	1.4	
T232	1.6	
SC229	1.7	
B77	1.7	
Mo18W	1.8	
Sc301D	1.8	
CI90C	1.9	
Tx601	2.0	
Mp490	2.3	
H55	2.6	
B37	2.8	
Ab28A	2.9	
Rating date August 8		
Mo20W	2.8	
Oh513	3.6	
T143	4.1	
T232	4.4	
Mo18W	4.7	
Tx601	5.0	
SC229	5.7	
Mp490	5.0	
T240	6.1	
B37	6.2	
B77	6.5	
Sc301D	6.6	
CI90C	7.1	
Ab28A	7.9	
H55	8.5	
Coefficient of variation	percent	18.4
Least significant difference		1.11

<sup>1</sup>Sponsored by the Southern Corn Improvement Conference.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

Springs location than at the Delta location. Inbred lines T232 and Tx601 appeared to have relatively lower ratings at the Delta Center than at House Springs. These results suggest a different virus complex at each of these two locations.

### Uniform Evaluation of Inbred Lines

A uniform test of new inbred lines, sponsored by the North Central Corn Breeding Research Com-

**Table 6. — 1974 virus ratings for a uniform evaluation test of inbred lines<sup>1</sup> grown on the Delta Center in Pemiscot County, Missouri. Planted May 29. Rated July 24 and August 8. Data are the averages of both dates (Exp. V-5).**

Inbred lines	Virus ratings	DMRT <sup>2</sup>
ND71-28	2.6	
Oh517	3.1	
B78	3.1	
(Syn. A High)-S <sub>3</sub> (1)	3.1	
Mo17C	3.1	
Oh7B*	3.2	
A71-18	3.2	
N156 (S891-3-1)	3.3	
W406	3.4	
Oh516	3.5	
Mo17D	3.5	
Oh561	3.5	
W438	3.6	
Mich. 74-3	2.6	
(Syn. A High)-S <sub>3</sub> (2)	3.6	
Pa409	3.7	
W117	3.8	
Mich. 74-2	3.8	
W64A	3.8	
Mo17	3.9	
MS71	3.9	
(Mo22 x A251)S <sub>9</sub>	3.9	
A71-9	3.9	
MS153	3.9	
B77	3.9	
Mich. 74-1	4.0	
MS70	4.0	
W153R	4.0	
(A251 x Mex. Syn. 17)-3-S <sub>9</sub>	4.0	
Oh512	4.1	
N157 (S891-3-2)	4.1	
W739A	4.1	
WP9	4.1	
(N38A x Oh41)S <sub>8</sub>	4.1	
(Syn. B High)-S <sub>3</sub> (1)	4.2	
Oh51A	4.2	
Pa405	4.2	
ND71-50	4.2	
A71-11	4.2	
Oh43	4.3	
Mo17H	4.4	
Pa887P	4.4	
W627C	4.4	
N162 (S891-3)	4.5	
A71-22	4.5	
Oh565	4.5	
Bl4	4.6	
W513	4.6	
ND71-42	4.7	
ND71-59	4.7	
N158 (S891-3-3)	4.7	
B37	4.7	
ND71-49	4.8	
Pa419P	5.0	
Mich. 74-4	5.0	
(FP20 x SD10)-1-S <sub>9</sub>	5.1	
A70-12	5.1	
B73	5.2	
WT29D	5.2	
Pa762	5.4	
(B57 x Bl4A)S <sub>8</sub>	5.8	
(Syn. B High)-S <sub>3</sub> (2)	5.9	
W462	6.1	
H55*	6.2	
Coefficient of variation		percent 21.9
Least significant difference		1.47

<sup>1</sup>Sponsored by the North Central Corn Breeding Research Committee.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

\*Check inbred lines.

**Table 7. — 1974 virus ratings for inbred lines in a uniform virus study<sup>1</sup> grown on the Delta Center in Pemiscot County, Missouri. Planted May 29. Experiment V-6.**

Inbred line	Virus ratings	DMRT <sup>2</sup>
Rating date July 2		
N6J	1.0	
Oh7B	1.0	
Mp339	1.0	
Ga209	1.0	
KY66-2500	1.0	
33-16	1.0	
SC357	1.0	
Mo12	1.1	
Oh509A	1.1	
Mo17C	1.1	

Rating date July 24

Mo12	2.1
Oh509A	2.2
Oh7B	2.3
SC357	2.5
Ky66-2500	2.7
Ga209	2.7
33-16	2.8
N6J	3.1
Mo17C	3.4
Mp339	3.5

Rating date August 8

Mo12	2.2
33-16	2.6
Ga209	3.0
SC357	3.1
Oh7B	3.2
Ky66-2500	3.3
N6J	4.3
Mo17C	4.3
Oh509A	4.6
Mp339	5.4

Coefficient of variation . . . . . percent 17.3

Least significant difference . . . . . .58

<sup>1</sup>Conducted by the Ohio Agriculture Research and Development Center.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

mittee (NCR-2), was grown at several locations in the North Central Region for disease ratings and stalk quality evaluation in 1974. This uniform test was grown only at the Delta Center (Exp V-5), and the virus ratings are reported in table 6. Ratings were made on July 14 and August 8. Because no significant interaction occurred between entries by dates, the results reported are the averages of both dates. No significant difference was found among the first 19 inbred lines listed with a range in ratings from 2.6 to 3.8.

Several of the new lines had acceptable levels of tolerance. Lines of early maturity that had high levels of tolerance are of special interest.

### Special Uniform Test of Inbred Lines

A special uniform test of 10 inbred lines (Exp D-6) was planted at the Delta Center. This test was sponsored by the Ohio Agricultural Research and Development Center at Wooster, Ohio. The test was made to study the virus complex over several locations in the main corn growing regions of the United States. The results are given in table 7. Analysis of variance showed that the entry by rating date interaction was highly significant. Ratings made on July 2 showed no significant difference among entries, and virus ratings became progressively higher for the later rating dates.

Table 8. — 1974 virus ratings for 12 S<sub>4</sub> lines<sup>1</sup> grown on the Delta Center, Pemiscot County, Missouri. Planted May 29. Experiment V-8.

Single cross	Virus ratings	DMRT <sup>2</sup>
Rating date July 24		
(AKH42 x Oh514)S <sub>4</sub>	2.0	
(AKD52 x Oh514)S <sub>4</sub>	2.0	
(Oh514 x Va35c)S <sub>4</sub>	2.3	
(AKD52 x W64A)S <sub>4</sub>	2.3	
(Va35c x Ne232)S <sub>4</sub>	2.3	
(AKD52 x NC234)S <sub>4</sub>	2.3	
(Tx4804-2 x Va35c)S <sub>4</sub>	2.3	
(Oh514 x AKD26)S <sub>4</sub>	2.6	
(Oh514 x B14)S <sub>4</sub>	2.7	
(Va35c x Tx602)S <sub>4</sub>	3.1	
(Oh43 x AR202)S <sub>4</sub>	3.2	
(B14 x T204D)S <sub>4</sub>	4.4	
Rating date August 8		
(AKD52 x Oh514)S <sub>4</sub>	2.8	
(Oh514 x Va35c)S <sub>4</sub>	3.0	
(Oh514 x AKD26)S <sub>4</sub>	4.0	
(Va35c x Ne232)S <sub>4</sub>	4.1	
(AKH42 x Oh514)S <sub>4</sub>	4.1	
(AKD52 x W64A)S <sub>4</sub>	4.3	
(AKD52 x NC234)S <sub>4</sub>	4.3	
(Tx4804-2 x Va35c)S <sub>4</sub>	4.9	
(Oh514 x B14)S <sub>4</sub>	5.1	
(Oh43 x AR202)S <sub>4</sub>	5.9	
(Va35c x Tx602)S <sub>4</sub>	6.4	
(B14 x T204D)S <sub>4</sub>	7.9	
Coefficient of variation	percent 19.2	
Least significant difference	1.13	

Table 9. — 1974 virus ratings in the open end test<sup>1</sup> for inbred lines grown on the Delta Center in Pemiscot County, Missouri. Planted May 29. Rated July 24. Experiment V-9.

Inbred lines	Virus ratings	DMRT <sup>2</sup>
T73:V717W	1.3	
(Mo14W x Oh7B)S <sub>3</sub> (yellow)	1.5	
SH61 <sup>3</sup>	1.5	
SC457	1.5	
T(CM103)	1.8	
Oh7B <sup>4</sup>	1.8	
Ark321	1.8	
SC443	1.8	
SC441	1.8	
SC451	1.8	
SC448	1.9	
T(LT538)	1.9	
(Mo14W <sup>2</sup> x Oh7B)S <sub>2</sub> (yellow)	1.9	
Mp71:234	1.9	
Mp72:342	2.0	
SC456	2.0	
SC455	2.0	
SC454	2.0	
SC450	2.0	
T61WC	2.0	
ARK334	2.1	
Cr1101	2.1	
ARK336	2.1	
(Syn A High)S <sub>3</sub>	2.1	
(Syn A High)S <sub>3</sub>	2.1	
SC459	2.1	
SH62 <sup>3</sup>	2.1	
ARK328	2.1	
(Mo14W x Oh7B)S <sub>3</sub> (white)	2.1	
SC458	2.2	
(Mo14W <sup>3</sup> x Oh7B)S <sub>2</sub> (yellow)	2.2	
Cr1102	2.2	
Mp72:363	2.2	
H98	2.2	
White Delight	2.2	
B76	2.2	
ARK309	2.2	
SC54	2.2	
SC453	2.2	
(Syn B High)S <sub>3</sub>	2.3	
R177	2.4	
(Mo14W <sup>2</sup> x Oh7B)S <sub>2</sub> (white)	2.4	
Mo14W <sup>4</sup>	2.5	
(Syn B High)S <sub>3</sub>	2.6	
SH63 <sup>3</sup>	2.6	
Oh512	2.8	
(Mo14W <sup>3</sup> x Oh7B)S <sub>2</sub> (white)	3.0	
Mp72:360	3.1	
T246A	3.1	
Mp71:247	3.2	
Mo5 <sup>4</sup>	3.3	
H55 <sup>4</sup>	4.2	
Coefficient of variation	percent 15.8	
Least significant difference	.82	

<sup>1</sup>Sponsored by the Southern Corn Improvement Conference.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

<sup>3</sup>Shrunken - 2 hybrids from Hawaii.

<sup>4</sup>Check inbred lines.

### S<sub>4</sub> Lines

Twelve S<sub>4</sub> lines from Dr. J. O. York<sup>3</sup> were rated for virus at the Delta Center (Exp V-8). Results are reported in table 8. Inbred line Oh514, as a parent, transmitted high levels of tolerance to three of four recovered S<sub>4</sub> lines.

<sup>3</sup>Professor of agronomy, University of Arkansas, Fayetteville.

## Open End Test of Inbred Lines

The Southern Corn Improvement Conference sponsored a test of new inbred lines for virus ratings (Exp V-9). Virus ratings were made at two different dates; the interaction of entries by dates

was highly significant. Therefore, the results for each rating date are separately reported in tables 9 and 10. A new experimental line from Tennessee, T73:V717W, appeared to have a level of tolerance similar to several lines from South Carolina.

Table 10. — 1974 virus ratings in open end test<sup>1</sup> for inbred lines grown on the Delta Center in Pemiscot County, Missouri. Planted May 29. Rated August 6. Experiment V-9.

Inbred line	Virus ratings	DMRT <sup>2</sup>
T73:V717W	2.5	
SC450	2.8	
SC454	3.0	
SC443	3.0	
SH62 <sup>3</sup>	3.2	
SH63 <sup>3</sup>	3.2	
SC459	3.2	
SC456	3.3	
SC441	3.4	
SH61 <sup>3</sup>	3.4	
ARK321	3.5	
(Syn A High)S <sub>3</sub>	3.6	
SC458	3.6	
SC451	3.6	
SC448	3.6	
SC455	3.7	
(Syn A High)S <sub>3</sub>	3.7	
Mp71:234	3.9	
T(LT538)	4.0	
SC457	4.0	
Oh7B**	4.0	
SC453	4.1	
Mp72:342	4.1	
T61WC	4.2	
(Syn B High)S <sub>3</sub>	4.2	
White Delight	4.3	
(Mo14W3 x Oh7B)S <sub>2</sub> (yellow)	4.3	
T246A	4.3	
Cr1102	4.4	
(Mo14W x Oh7B)S <sub>3</sub> (yellow)	4.5	
Mp72:360	4.5	
Mp72:363	4.5	
(Syn B High)S <sub>3</sub>	4.6	
ARK328	4.7	
(Mo14W2 x Oh7B)S <sub>2</sub> (white)	4.7	
Mp71:247	4.7	
ARK336	4.7	
SC54	4.8	
(Mo14W2 x Oh7B)S <sub>2</sub> (yellow)	4.8	
(Mo14W x Oh7B)S <sub>3</sub> (white)	4.9	
ARK334	5.0	
B76	5.0	
R177	5.1	
T(CM103)	5.1	
H98	5.2	
Cr1101	5.3	
Mo14W*	5.5	
ARK309	5.6	
Oh512	5.7	
(Mo14W3 x Oh7B)S <sub>2</sub> (white)	5.9	
Mo5*	6.7	
H55*	7.1	
Coefficient of variation		percent 15.8
Least significant difference		

<sup>1</sup>Sponsored by the Southern Corn Improvement Conference.

<sup>2</sup>Duncan's Multiple Range Test—Entries with the same line in common are not considered significantly different at the 5% level.

<sup>3</sup>Shrunken - 2 hybrids from Hawaii.

\*Check inbred lines.



# Virus Tolerance Ratings of Corn Inbred Lines Grown in Ohio<sup>4</sup>

by

W. R. Findley, E. J. Dollinger, J. K. Knoke and Raymond Louie<sup>5</sup>

For ratings in Ohio of virus disease as a result of natural infection, corn inbred lines were grown in plots on Vaughter's farm located along the Ohio River near Portsmouth, Ohio.

The ratings reported here include tests sponsored by the Ohio Agricultural Research and Development Center, North Central Corn Breeding Research Committee, and Southern Corn Improvement Conference.

Seeds of the corn lines were planted in replicated plots on May 16. Twenty-five seeds were single-space planted in 18-foot one-row plots. Between plots aisles were 4 feet and rows were 38 inches apart. Inbreds, sponsored by the Southern Corn Improvement Conference, were grown in three replications, and those in the other two tests were grown in two replications.

Seedling emergence generally was good, resulting in satisfactory stands in nearly all plots. Weather conditions were favorable for corn growth, except for 3 weeks without rain from late June to mid-July. During the dry period the plants showed signs of moisture stress, particularly those severely infected with virus. Weed competition became a problem in August.

## Virus Incidence

Maize dwarf mosaic (MDM) and maize chlorotic dwarf (MCD) were present in high incidence throughout the season. Both diseases occurred early in the season. MDMV strain B is usually nonexistent in the plot area. However, in 1974 MDMV-B appeared more prevalent beginning in mid-July than in previous years. Disease intensity of MCD was highest and occurred much earlier than in other years.

MDM and MCD probably have occurred in the test area for several years, although MCD was not identified as part of the disease complex until 1972. Both viruses overwintered in johnsongrass

and become problems where this grass occurred in abundance.

Symptoms of MDM appear as chlorotic patterns of mosaic, ring, fleck, mottle and streak, primarily on the youngest leaves. The diagnostic symptom for MCD was chlorotic streaking in the smallest (tertiary) leaf veins. Severe infection by one virus often masked the symptoms of the other.

## Virus Rating Systems

Individual plants were rated for symptoms of MDM and MCD on July 23, July 27, or August 21. Virus severity ratings on individual plants in the Southern Corn Improvement Conference uniform open end virus test were made on June 27 and August 21. Early ratings, which included symptoms of chlorosis, were made using a 1 to 4 scale:

- 1 — Healthy.
- 2 — Chlorotic symptoms restricted to a few longitudinal streaks in upper leaves (light).
- 3 — Chlorotic symptoms throughout leaf blade of upper one to three leaves (moderate).
- 4 — Chlorotic symptoms throughout more than three leaves (severe).

The late ratings, which included symptoms of chlorosis and stunting, were made using a 1 to 9 scale:

- 1 — Healthy.
- 2 — Virus-like symptoms in top two or three leaves.
- 3 — Virus-like symptoms in more than three leaves; plant not stunted.
- 4 — Virus-like symptoms in more than three leaves; plant slightly stunted.
- 5 — Virus-like symptoms in more than three leaves; plant moderately stunted; ear size slightly reduced.
- 6 — Severe symptoms in more than three leaves; plant height reduced one-fourth to one-half; ear size moderately reduced.
- 7 — Severe symptoms in more than three leaves; plant height reduced about one-half; poor ear shoot, many kernels.
- 8 — Severe symptoms in more than three leaves; plant height reduced one-half or more; poor or no ear shoot, few or no kernels.
- 9 — Dead plant, no ear shoot.

The 1 to 9 scale also was used for virus ratings made August 15 and September 16 on a plot basis of plants in the Ohio Agricultural Research and Development Center test.

<sup>4</sup>Cooperative investigations of the Agricultural Research Service, U.S. Department of Agriculture and the Ohio Agricultural Research and Development Center, Wooster, Ohio.

<sup>5</sup>Research agronomist, Agr. Res. Ser., U.S. Dept. of Agr.; professor of agronomy, Ohio Agr. Res. and Dev. Ctr.; and research entomologist and research plant pathologist, Agr. Res. Ser., U.S. Dept. of Agr., Wooster, Ohio.

## Uniform Evaluation of Inbred Lines

Percentages of MDMV-infected plants, virus ratings and plant numbers are reported in table 11 and percentages of MCDV-infected plants in table 12 on inbred line entries by the Ohio Agricultural Research and Development Center. Apparently percentages of MDMV-infected plants were lower than in most previous years for such lines as H55, Oh45 and M14. Conversely, percentages were higher for such inbreds as Oh7B and Ky61-2335. Percentages of MCDV-infected plants were very high for most lines. Probably symptoms of MDM were masked by those of MCD.

MDMV symptoms on inbred lines Oh7B and Ky61-2335 may have been due to strain B. These lines are susceptible to strain B and resistant to strain A of MDMV. Virus ratings on entries in replication 1 were made on August 15, however, ratings in replication 2 were delayed until September 16 because of inclement weather. Low virus ratings for lines with high percentages of virus-infected plants indicated tolerance to the disease complex.

Inbred line percentages of MDMV- and MCDV-infected plants in the uniform test sponsored by the North Central Corn Breeding Research Committee are reported in tables 13 and 14. Lines in this test did not differ statistically in percentages of MCDV-infected plants.

Severity ratings and percentages of MDMV- and MCDV-infected plants on lines included in the Southern Corn Improvement Conference sponsored test are reported in tables 15, 16 and 17. The June ratings were made before plant types discernable as volunteers could be identified, and rogued, which accounts for most of the discrepancies in plant numbers reported for the two rating dates. Some desired plant types were destroyed in the roguing process.

Coefficient of variation values and when applicable, least significant differences (L.S.D.) at the 5 percent level and standard error (S.E.) were computed for each variable. The L.S.D. is useful in determining differences larger than 5 percent because of the chance 19 times in 20. It should be used with a common standard in making comparisons. The standard error may be used to determine the shortest significant range (Rp) values in Duncan's New Multiple Range Test.

Table 11. — Incidence of maize dwarf mosaic (MDM), virus ratings and total plant counts on inbred lines in the Ohio Agricultural Research and Development Center test.

Inbred	Total plants	MDM Jul. 23	Virus ratings <sup>1</sup>	
			Rep. 1 Aug. 15	Rep. 2 Sep. 16
	Number	Percent		
Pa405	32	6.2	7	5
Oh513	38	10.5	4	4
Oh07	35	11.4	7	9
T232	45	13.3	4	4
Oh509	44	15.9	5	6
A	36	16.7	9	9
CI.44	38	18.4	5	4
Mo20W	37	21.6	4	5
CG1	32	21.9	7	7
Mo18W	45	22.8	6	5
GA209	39	23.1	4	5
GT3	38	23.7	5	5
A73	21	23.8	5	8
H55	33	24.2	9	9
Oh422	36	25.0	9	9
Ky61-2335	39	25.6	4	7
B14	18	27.7	7	9
(Oh7NxOh07) <sub>S</sub> <sub>8</sub>	39	28.2	7	8
Ky135	33	28.4	8	7
N7B	35	28.6	5	5
(Ky61-2335x Oh41 <sup>2</sup> ) <sub>S</sub> <sub>6</sub>	36	30.5	5	6
Mo12	36	30.6	5	9
Oh72-588	31	32.2	5	7
B69	30	33.3	8	8
Tx601	32	34.4	6	4
K44	31	35.5	7	7
N6J	37	37.8	6	5
Oh45	42	38.1	9	9
M14	39	38.5	7	9
Oh514	18	38.9	5	8
N6	38	39.5	4	7
Ky66-2500	43	39.5	7	6
Oh511	40	40.0	6	9
SC254	27	40.7	6	5
Oh509A	34	41.2	5	7
K150	37	43.2	8	8
Oh512	41	43.9	7	6
A375	35	45.7	7	9
Oh7B	30	46.7	6	6
B54	34	47.0	7	7
GT112	42	47.6	6	9
33-16	47	48.9	6	7
A239	30	50.0	5	9
Pa32	38	50.0	8	9
Ky128	38	51.5	7	7
Va35	44	52.3	7	7
B37	32	54.1	7	9
Pa884P	45	55.5	6	4
Oh41	26	57.7	8	8
Mo5	42	59.5	9	9
Oh7K	40	60.0	7	7
CI.38B	43	62.7	7	6
K61-1	19	63.2	6	5
CI.21E	37	64.9	7	7
N20	38	65.8	7	8
Ky226	39	66.7	6	7
C103	32	70.6	5	5
Oh43	29	72.6	8	8
Oh7N	44	77.3	8	8
H95	45	86.7	5	4

Least significant differences . . . . . 28.49

Standard error . . . . . 10.03

Coefficient of variation . . . . . percent 14.3

<sup>1</sup> Virus ratings reflect the disease severity in an inbred line irrespective of the pathogen involved.



Table 12. — Incidence of maize chlorotic dwarf (MCD) on inbred lines in the Ohio Agricultural Research and Development test on July 23, 1974.

Inbred	MCD
	Percent
H95	46.7
CG1	50.0
Oh513	52.6
Mo12	52.8
Pa884P	55.5
CI.44	60.5
A239	66.7
C103	67.6
N6J	67.6
Mo20W	70.3
GT3	76.3
Oh7B	76.7
Oh7K	77.5
(Ky61-2335xOh41 <sup>2</sup> )S <sub>6</sub>	77.8
GA209	79.5
Oh72-588	80.6
33-16	80.8
Ky66-2500	81.4
SC254	81.5
Oh43	82.0
N7B	82.8
B14	83.3
K61-1	84.2
Tx601	84.4
Oh07	85.7
Oh509	86.4
CI.21E	86.5
N6	86.9
Ky226	87.2
Ky135	87.8
GT112	88.1
Mo18W	88.9
Ky61-2335	89.7
K44	90.3
A73	90.5
Oh509A	91.2
A375	91.4
Oh512	92.7
B37	93.3
Pa405	93.7
Oh514	94.4
Pa32	94.7
(Oh7NxOh07)S <sub>8</sub>	94.9
Oh41	96.1
B69	96.7
B54	97.0
K150	97.3
N20	97.4
Oh511	97.5
Oh45	97.6
Oh7N	97.7
A	100.0
M14	100.0
H55	100.0
Mo5	100.0
Oh422	100.0
T232	100.0
CI.38B	100.0
Va35	100.0
Ky128	100.0
Least significant differences	25.2
Standard error	8.85
Coefficient of variation	percent 14.3

Table 13. — Incidence of maize dwarf mosaic (MDM) on inbred lines in the North Central Corn Breeding Research Committee uniform test on July 23, 1974.

Inbred	MDM
	Percent
W117	0
Pa405	0
N156(S891-3-1)	2.7
N162(S891-3)	6.5
(Mo22xA251)S <sub>9</sub>	7.7
(N38AxOh41)S <sub>8</sub>	14.2
Oh516	14.3
W438	17.2
N158(S891-3-3)	17.8
Pa887P	20.0
Oh7B	20.6
MS70	23.9
W462	25.6
Mich.74-1	26.9
N157(S891-3-2)	27.2
A71-9	28.2
(A251xMex.Syn.17)-3-S <sub>9</sub>	29.1
MS153	29.5
Mo17C	30.3
Mich.74-2	30.3
Mo17D	33.2
A71-11	33.5
(Syn.A High)S <sub>3</sub> (2)	34.1
W627C	35.2
W739A	35.4
ND71-49	36.3
B77	37.9
B14	39.3
Oh51A	41.2
Oh512	41.2
(PP20xSD10)-1-S <sub>9</sub>	41.5
W406	42.1
A71-18	42.6
(B57xB14A)S <sub>8</sub>	42.8
W64A	42.9
(Syn.B High)S <sub>3</sub> (2)	43.1
B78	44.8
Mo17H	46.7
WF9	47.5
Pa419P	48.8
B37	49.7
Mich.74-3	50.6
A71-22	52.8
Oh517	54.1
MS71	54.4
W513	55.6
Oh565	55.6
ND71-50	56.4
W729D	56.7
Oh561	58.8
Pa409	60.5
ND71-42	61.7
(Syn.A High)S <sub>3</sub> (1)	63.2
W153R	64.6
A70-12	65.9
Mich.74-4	69.1
ND71-28	69.8
Oh43	74.7
Pa762	79.0
H55	80.1
(Syn.B High)S <sub>3</sub> (1)	84.8
ND71-59	87.5
Least significant differences	37.48
Standard error	13.25
Coefficient of variation	percent 44.9

Table 14. — Incidence of maize chlorotic dwarf (MCD) on inbred lines in the North Central Corn Breeding Research Committee uniform test on July 23, 1974.

Inbred	MCD
	Percent
W729D	47.6
(PP20xSD10) -1-S <sub>9</sub>	69.0
Mich. 74-1	72.7
MS70	75.0
Oh7B	76.2
Mo17D	77.1
Pa419P	82.0
(Syn. A High)S <sub>3</sub> (2)	83.3
Mo17C	83.9
Oh43	84.0
(N38AxOh41)S <sub>8</sub>	85.0
A71-11	86.5
Mich. 74-2	87.5
B77	88.2
A71-9	88.4
Oh517	89.3
A71-18	89.5
Oh51A	89.6
W627C	89.7
B14	90.1
Oh516	90.2
W64A	91.7
ND71-49	92.6
W513	93.1
W739A	93.5
Pa409	93.5
B78	93.5
B37	94.1
Oh512	94.1
ND71-59	94.4
A71-22	94.4
(Syn. B High)S <sub>3</sub> (2)	94.7
H55	94.7
A70-12	96.0
(Syn. A High)S <sub>3</sub> (1)	96.0
ND71-28	96.3
Oh565	96.3
MS71	96.8
W406	97.0
(A251xMex. Syn. 17) -3-S <sub>9</sub>	97.0
W153R	97.2
Pa762	97.2
MS153	97.3
N157(S891-3-2)	97.4
W438	97.6
Mich. 74-3	97.6
Pa405	97.8
ND71-42	100.0
ND71-50	100.0
W117	100.0
W462	100.0
Oh561	100.0
Mich. 74-4	100.0
(Syn. B High)S <sub>3</sub> (1)	100.0
Pa887P	100.0
Mo17H	100.0
(B57xB14A)S <sub>8</sub>	100.0
N158(S891-3-3)	100.0
N156(S891-3-1)	100.0
N162(S891-3)	100.0
WF9	100.0
(Mo22xA251)S <sub>9</sub>	100.0
Coefficient of variation . . . . .	percent 12.3

Table 15. — Virus severity ratings and total plant counts on inbred lines in the Southern Corn Improvement Conference uniform open end virus test, 1974.

Inbred	Total Plants		Severity Rating	
	Jun. 27	Aug. 21	Jun. 27	Aug. 21
Mp71:234	23	21	1.2	5.5
SC441	65	54	1.3	4.8
Mp72:363	51	47	1.6	5.1
(Mo14WxOh7B)S <sub>3</sub> (yellow 2)	58	52	1.6	5.3
T61 w.c.	62	59	1.7	4.3
SC450	64	64	1.7	6.2
T(CM103)	60	51	1.7	6.5
(Mo14W <sup>3</sup> xOh7B)S <sub>2</sub> (yellow 6)	65	55	1.8	5.5
Ark309D	56	41	1.8	7.1
SC454	61	51	1.8	5.3
SC456	68	63	1.8	5.4
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (white 3)	45	37	1.8	6.7
Ark336	40	33	1.8	7.8
T246A	38	27	1.9	6.1
SC459	60	49	1.9	6.4
SC453	65	58	1.9	5.1
T(LTS38)	68	57	1.9	5.6
(Syn. A High)S <sub>3</sub> (9)	61	50	1.9	8.1
SC54	57	53	1.9	5.5
SC457	66	58	1.9	6.0
T73:V717W	74	53	1.9	4.9
SC443	67	52	2.0	4.8
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (yellow 4)	50	47	2.1	5.3
(Mo14WxOh7B)S <sub>3</sub> (white 1)	56	47	2.2	5.5
Ark321	57	32	2.2	6.4
SC451	70	60	2.3	5.6
(Syn. B High)S <sub>3</sub> (10)	51	34	2.4	8.6
Mp72:360	62	57	2.4	7.3
SC455	65	61	2.4	5.5
Mp72:342	46	44	2.4	7.6
Oh512	55	28	2.5	7.6
(Mo14W <sup>3</sup> xOh7B)S <sub>2</sub> (white 5)	41	35	2.6	7.7
Ark334	31	18	2.6	6.9
Ark328	58	41	2.8	8.1
(Syn. A High)S <sub>3</sub> (8)	65	45	3.0	8.5
SC458	63	54	3.0	5.6
SC448	59	51	3.0	8.0
(Syn. A High)S <sub>3</sub> (7)	54	49	3.2	8.7
Mp71:247	45	42	3.3	6.5
Least significant differences . . . . .			1.42	1.79
Standard error . . . . .			.50	.64
Coefficient of variation . . . . .			percent 41.1	17.0

Table 16. — Incidence of maize dwarf mosaic (MDM) on inbred lines in the Southern Corn Improvement Conference uniform open end virus test, 1974.

Inbred	MDM Jun. 27	MDM Aug. 21
	Percent	Percent
Mp71:234	0	55.3
(Mo14WxOh7B)S <sub>3</sub> (yellow 2)	1.8	16.3
SC456	2.9	40.4
T(CM103)	3.0	36.1
(Syn.B High)S <sub>3</sub> (10)	6.0	30.8
(Mo14W <sup>3</sup> xOh7B) (yellow 6)	6.1	31.4
SC450	6.4	67.2
SC54	7.0	82.2
T(LT538)	7.2	26.8
Oh512	7.2	29.0
SC441	7.8	38.9
Mp72:363	10.0	47.8
T73:V717W	10.3	27.3
Ark309D	11.3	42.1
SC453	12.0	84.5
SC459	13.5	61.6
SC454	13.8	65.7
T61 w.c.	14.1	37.4
Ark336	18.3	58.3
SC457	18.6	49.6
SC451	21.2	51.9
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (white 3)	24.8	64.9
Mp72:360	27.2	72.7
(Syn.A High)S <sub>3</sub> (7)	27.3	34.5
SC443	27.5	57.7
Ark321	29.0	39.6
Ark328	30.4	50.6
Ark334	33.7	68.5
T246A	36.9	96.7
(Syn.A High)S <sub>3</sub> (9)	37.5	45.6
SC448	38.1	45.9
SC455	43.9	60.6
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (yellow 4)	48.4	85.3
(Mo14WxOh7B)S <sub>3</sub> (white 1)	50.0	72.6
(Mo14W <sup>3</sup> xOh7B)S <sub>2</sub> (white 5)	51.1	77.4
(Syn.A High)S <sub>3</sub> (8)	55.6	67.9
Mp72:342	55.8	72.6
SC458	64.8	91.7
Mp71:247	83.5	100.0
Least significant differences	25.07	27.27
Standard error	8.91	9.69
Coefficient of variation	percent 62.4	29.9

Table 17. — Incidence of maize chlorotic dwarf (MCD) on inbred lines in the Southern Corn Improvement Conference uniform open end virus test, 1974.

Inbred	MCD Jun. 27	MCD Aug. 21
	Percent	Percent
Ark336	10.0	85.3
(Mo14WxOh7B)-S <sub>3</sub> (white 1)	10.3	52.1
SC441	12.3	60.4
(Syn.A High)S <sub>3</sub> (9)	14.7	80.4
Mp72:363	15.6	74.4
T246A	15.7	44.1
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (yellow 4)	20.0	64.0
SC443	22.3	63.6
SC454	22.9	85.1
(Mo14WxOh7B)S <sub>3</sub> (yellow 2)	24.1	91.8
(Mo14W <sup>2</sup> xOh7B)S <sub>2</sub> (white 3)	24.4	84.2
Mp71:234	26.0	93.8
T61 w.c.	27.8	64.8
Ark309D	30.3	83.7
SC450	30.7	89.4
(Mo14W <sup>3</sup> xOh7B)S <sub>2</sub> (yellow 6)	31.3	92.1
SC459	32.2	90.0
SC456	32.8	89.0
(Mo14W <sup>3</sup> xOh7B)S <sub>2</sub> (white 5)	33.3	88.0
T(CM103)	33.3	79.2
T(LT538)	33.8	70.4
Mp71:247	34.4	100.0
SC457	34.8	79.9
T73:V717W	35.1	86.2
Ark321	38.5	93.9
Mp72:342	41.3	81.2
SC451	41.4	72.6
SC453	41.5	81.4
SC54	43.8	91.1
SC455	44.6	86.8
Ark334	50.0	100.0
SC448	50.8	88.2
Oh512	50.9	88.9
(Syn.A High)S <sub>3</sub> (8)	51.5	89.6
Mp72:360	53.9	90.0
Ark328	60.3	96.7
(Syn.B High)S <sub>3</sub> (10)	60.7	72.9
SC458	61.9	81.9
(Syn.A High)S <sub>3</sub> (7)	85.1	100.0
Least significant differences (5% level)	26.49	26.24
Standard error	9.41	9.32
Coefficient of variation	percent 28.5	19.6

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